We claim:

1. A lithographic apparatus comprising:

a radiation system to provide a projection beam of radiation, the radiation system comprising an illumination system for defining a position dependent intensity distribution of the beam in a pupil plane;

a support structure for supporting patterning structure, the illumination system defining an angle dependent intensity distribution of the beam at the patterning structure dependent on the position dependent intensity distribution in the pupil plane;

a substrate table for holding a substrate;

a projection system for projecting the patterned beam onto a target portion of the substrate;

a beam splitter positioned in a path of the projection beam during operation of the lithographic apparatus, the beam splitter splitting off an auxiliary beam, and

a detector with a detection element in a path of the auxiliary beam to detect information about a position dependent intensity distribution corresponding to the pupil plane.

2. A lithographic apparatus according to claim 1, comprising an optical element with a controllable parameter and a controller having an input coupled to said detector and an output coupled to the optical element for controlling said parameter dependent on the detected information.

3. A lithographic apparatus according to claim 2, the controller having an interface for receiving a desired position dependence of the intensity distribution at the pupil plane, the controller being arranged to regulate the parameter so as to approximate the desired position dependence.

4. A lithographic apparatus according to claim 2, wherein the optical element comprises a matrix of elements, each redirecting the projection beam in a respective individually controllable direction, the controller being arranged to adapt a fraction of the elements that redirect the beam to an area in said pupil plane dependent on a discrepancy between a desired and a measured intensity over said area.

5. A lithographic apparatus according to claim 2, wherein the controller is arranged to control the parameter dependent on the measured position dependence at least during exposure of a substrate.

6. A lithographic apparatus according to claim 1, wherein the beam splitter is located at an offset from the pupil plane in the path of the projection beam, the detection element being arranged to detect an intensity distribution across the auxiliary beam, the apparatus comprising a deconvolution unit for deconvoluting a discrepancy between the intensity distributions at the pupil plane and at the detection element due to propagation of radiation along a sub-path between the pupil plane and the detection element.

7. A lithographic apparatus according to claim 1, wherein the beam splitter comprises a mirror surface that reflects a portion of the projection beam, the mirror surface transmitting a further portion of the projection beam as the auxiliary beam, the detection element intercepting the auxiliary beam substantially at a back side of the mirror surface.

8. A lithographic apparatus according to claim 1, wherein the beam splitter comprises a mirror surface that reflects a portion of the projection beam, the mirror surface transmitting a further portion of the projection beam as the auxiliary beam, the detection element intercepting the auxiliary beam following the mirror surface, a correction optical element or optical elements being included between the mirror surface and the detection element.

9. A lithographic apparatus according to claim 1, comprising an initial pupil plane, a light conducting rod with reflecting side walls to reduce position dependence of the intensity distribution of the beam, the rod being included in the path of the projection beam between the initial pupil plane and a first image plane of the initial pupil plane, and one or more optical elements to image the initial pupil plane onto the first image plane of the pupil plane, the beamsplitter being located optically downstream of the rod.

10. A lithographic apparatus according to claim 1, wherein the beam splitter is located in the path of the beam preceding the initial pupil plane.

11. A device manufacturing method comprising:

providing a projection beam having a position dependent intensity distribution in a pupil plane of radiation using a radiation system, the position dependence determining an angle dependence of the intensity distribution of the projection beam at a substrate;

patterning the projection beam with a pattern in its cross-section;

projecting the patterned beam of radiation onto a target portion of a layer of radiation-sensitive material on the substrate;

splitting an auxiliary beam from the projection beam;

measuring an intensity distribution across the auxiliary beam; and

controlling an intensity distribution at the pupil plane, dependent on the intensity distribution measured across the auxiliary beam.

12. A device manufacturing method according to claim 11, wherein a desired position dependence of the intensity distribution at the pupil plane is received, and a parameter of the illumination system is used in a feedback loop under control of the measured position dependence so as to make the position dependence of the intensity distribution of the beam approximate the desired position dependence.

13. A device manufacturing method according to claim 12, wherein the illumination system comprises a matrix of elements, each redirecting the projection beam in a respective individually controllable direction, the method comprising adapting a fraction of the elements that redirect the beam to an area in said pupil plane dependent on a discrepancy between a desired and a measured intensity over said area.

14. A device manufacturing method according to claim 11, wherein the controller is arranged to control said parameter dependent on the measured position dependence during exposure of the layer of radiation-sensitive material.

15. A device manufacturing method according to claim 11, wherein the auxiliary beam is split from the projection beam at a location at an offset from the pupil plane in the path of the projection beam, and measuring comprises measuring the intensity distribution at a surface across the auxiliary beam, and deconvoluting a discrepancy between the intensity distributions at the pupil plane and said surface due to propagation of radiation along a sub-path between the pupil plane and the detection element.

16. A device manufacturing method according to claim 11, wherein said splitting is performed using a partially transparent mirror surface from which a portion of the projection beam is reflected and a further portion is transmitted forming the auxiliary beam, which is intercepted substantially at a back surface of said mirror surface for detection of the intensity distribution.

17. A device manufacturing method according to claim 11, comprising homogenizing the intensity distribution of the projection beam, said auxiliary beam being split off after homogenizing.

18. A device manufacturing method according to claim 11, comprising regulating a position dependence of the intensity distribution of the projection beam at the substrate in parallel with regulating the position dependence at the pupil plane.